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**Dr. G. S. Buchanan's Report to the Local Government Board on an Outbreak of Illness at Mansfield caused by eating Potted Meat.**

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R. THORNE THORNE,

Medical Officer,

June 15th, 1896.

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IN February 1896 the Medical Officer of Health of the Borough of Mansfield, Dr. Wills, reported to the Board the sudden occurrence in that town of a plurality of attacks of illness resembling "food poisoning," due, as he suspected, to consumption of certain samples of potted meat.

**MAIN FEATURES OF THE OUTBREAK.**

Having received instructions to make inquiry into the matter, I visited Mansfield, and, with the assistance of Dr. Wills, set about collecting facts with regard to all the cases of this illness which could be heard of. It will be convenient to state at once that although we heard rumours of several different articles of food—pork pies, brawn, sausages, "polonies," and the like—having caused the illness from which particular people suffered, yet detailed inquiry showed that every one of those attacked had consumed one article in common, a certain "potted meat"—a recently-prepared compound, to be distinguished from the class of potted meats sold in hermetically sealed tins—made by a butcher in the town, to whom I will refer as Mr. X.

In response to a circular letter addressed to the several medical practitioners in Mansfield and the neighbourhood, these gentlemen very kindly supplied me with information as to persons in their practices who had been attacked. These persons, together with those of whom Dr. Wills and I heard from other sources, amounted in all to 265. Other cases no doubt occurred which did not come to our knowledge, but the number escaping recognition must needs have been comparatively insignificant.

*Symptoms.*

The history given by those attacked was of an illness characterised by gastro-enteric disturbance—diarrhœa, vomiting, and colic. Diarrhœa was the first sign of illness in most cases, and occurred during some part of the attack in almost all. It was profuse diarrhœa, and the motions were generally said to have been dark (sometimes they were described as black); almost always, it would appear, they were highly offensive. Vomiting was a frequent occurrence at the first onset of the illness, but had not often continued after the first two days of attack. Colic was usually severe, and patients who had profuse diarrhœa along with acute abdominal pain had, in some instances, become alarmingly collapsed.

These symptoms were accompanied by, and in a few instances appeared to have been preceded by, febrile and nervous disturbances. The fever was

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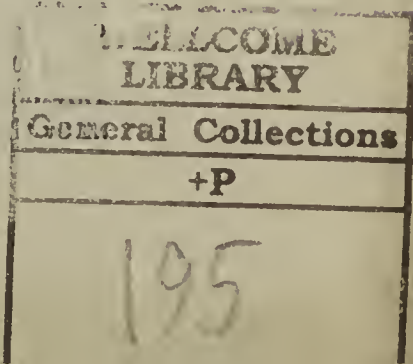
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sometimes considerable. I was unable to procure a systematic record of temperature in any of the cases. But I heard of two adults in whom the illness began with a rigor and a temperature of over  $104^{\circ}$  F. in each case. And shivering, hot skin, restlessness, and other signs of fever were described by many sufferers. In those who had a moderately severe illness the fever lasted, as a rule, three or four days.

Nervous disturbance was indicated by intense headache (usually frontal), giddiness, and general muscular pains. Some of the medical men told me of cases where, the gastro-enteric symptoms not being conspicuous, the acute headache, general pains, and fever had given the onset of the illness considerable similarity to that of influenza. Irregular nervous symptoms were reported in some instances. A woman of 50 said that she had suddenly been attacked by giddiness, followed by almost complete blindness for several hours. In two instances (neither accompanied by severe diarrhœa or collapse) a temporary loss of power in the limbs was reported. Giddiness, unsteady gait, involuntary and muscular twitchings and jerkings were heard of in a considerable proportion of the cases.

Excessive thirst was always spoken of, and the patients' tongues and mouths became very dry and parched. I saw two children with well marked thrush, said to have come on after their illness. No skin eruptions were heard of. I noticed that several persons attacked had patches of recent herpes on their lips. No clinical observations as to the urine of patients were obtainable, but I was told of dark coloured and scanty urine by most of the sufferers. No cases of suppression of urine were heard of. I did not learn of any pulmonary complications.

#### *Duration of Illness.*

Some of the attacks had been mild, and had consisted merely of a gastro-enteric disturbance of one or two days' duration. But the majority of cases had been ill for a week or longer. The usual history was one of complete prostration, with some or all of the symptoms above, lasting three or four days, and then a slow recovery. Diarrhœa, in particular, had frequently continued (though less severely than at first) for a week or more after the general illness had abated. Headache, loss of appetite, and general weakness, were still complained of by many persons whom I saw two or three weeks after their attack. No deaths occurred among those attacked. The worst case heard of was that of a boy who was severely ill for several weeks, but ultimately recovered.\*

#### *Incubation Period.*

The time which elapsed between eating the potted meat and the first sign of illness was inquired about in each case heard of. It could not always be determined, as in some instances the preparation had been eaten on more than one occasion, and in others the symptoms had been slight, and in consequence the facts about the illness had not received much attention. In 108 out of 218 cases in which a definite history was obtainable the first signs of illness had appeared between 18 and 24 hours after eating the potted meat. Other 64 persons had been attacked between 12 and 18 hours, nine in less

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\* This boy, aged 14, had an unusually protracted illness. He was attacked after eating about 2 ozs. of the potted meat. His father, mother, and a sister of 12 years, had between them eaten 6 ozs. of the same potted meat at the same time. Each of the latter went through a moderately severe attack, while a baby who had received a morsel was also ill. Unlike the others, the boy had no diarrhœa, and had not vomited during the first few days of his illness. He seemed very ill from the first, wasted rapidly, was restless, sleepless, and feverish. In the second week he was slightly delirious at night. He complained of severe headache throughout. With Dr. Godfrey's concurrence, I saw this boy three weeks after his attack. I then noted that he was very weak and prostrate, with a general aspect like that of a typhoid fever patient in the second or third week. The nurse told me that his temperature for the last three days had varied from about  $101^{\circ}$  in the morning to about  $103^{\circ}$  at night. He was slightly delirious, muttering, drowsy, and stupid. Pulse 120, feeble and dicrotous. Fauces injected. Tongue dry and brown. Sordes on lips. Respiration 30; a little cough. No rash. Abdomen somewhat tender; spleen just felt. Said to have slight diarrhœa, with motions which are natural in colour but offensive. Urine scanty. Boy complains of abdominal pains and bad frontal headache. I learn that he gradually improved after the fourth week, without further complication.





than 12 hours, while in the remaining 37 no illness had appeared for more than 24 hours after partaking of it. The longest period of latency was 48 hours, and the shortest was five hours. In one instance a woman vomited immediately after she had eaten the potted meat, and escaped further illness.

It did not appear that the amount of potted meat consumed in each instance had any definite relation to the length of the interval between swallowing the food and the onset of symptoms of illness.

### THE CAUSE OF THE OUTBREAK.

As has been said, the mischief was in each instance traceable to potted meat made by Mr. X. Particular illustration is afforded by facts as follows:—

- (1.) In not a few households all those who had eaten potted meat were attacked, whereas all who had not eaten escaped.
- (2.) Certain persons attacked in households into which potted meat had not been introduced were found in each instance to have consumed the preparation when on a visit.
- (3.) In each of those places near Mansfield where the potted meat had been distributed—Bolsover and Hill Town, Pleasley Vale, Warsop,\* and elsewhere—illness occurred only among those who consumed it.

And the virulence of the substance was remarkable. To give one instance, 4 lbs. of the potted meat, retailed from a small shop in Hill Town, caused illness in each of the 21 persons who had eaten it. Indeed, of a total of 279 persons who were ascertained to have eaten the potted meat, not more than 14 could be said to have escaped illness.

#### *Distribution of the Implicated Potted Meat.*

The potted meat in question was made on Mr. X.'s premises on February 11th, and it was on sale at his shop in Mansfield from February 12th to 14th. A small quantity was also sold on these days from a second shop which Mr. X. keeps in another part of Mansfield.

On February 12th and 13th, this substance, along with other preparations—chiefly pork-pies, “polonies,” and sausages—was taken by Mr. X.'s traveller to five retail shops in Mansfield. Three of these are co-operative stores, while two are kept by small general dealers. The three co-operative stores received a further supply of the same potted meat on February 14th. The total quantity supplied to all these retail shops in Mansfield in these three days was 49½ lbs., nearly all of which had been sold out by February 15th. On February 12th the traveller took other 8 lbs. to co-operative stores in Pleasley Vale, five miles out of Mansfield, and on the 13th he supplied 10 lbs. to certain shops in Bolsover and Hill Town, nine miles away. On Thursday, 13th, Mansfield market day, 10 lbs. were bought at Mr. X.'s shop by a shopkeeper at Warsop, and retailed from stores in that village. The potted meat was also sold at the Mansfield shop to some of the country people marketing on that day.

By February 15th Mr. X.'s traveller had heard that the preparation was supposed to be causing illness. Accordingly, when he went on his rounds on that day and on the 17th, he inquired at the several shops for any potted meat yet unsold. He was, however, able to collect a few pounds only, and this Mr. X. disposed of in his “blood tubs,” the contents of which were subsequently taken away by a farmer for manure.

Meanwhile, potted meat had again been made on Mr. X.'s premises on February 14th, and on the next day this new supply was distributed to certain retail shops as before. A shop at Wodehouse had received none of the February 11th potted meat, but was now supplied with this fresh preparation. No one who consumed this potted meat at Wodehouse was affected. Similar freedom from illness was heard of among persons who had bought potted meat (presumably that of February 14th) at Mr. X.'s shop

\* These places are comprised in the urban districts of Bolsover, Mansfield Wodehouse, and Warsop respectively.



in Mansfield on February 15th or later. Purchasers of potted meat on February 15th, at the retail shops from which the February 11th preparation had been removed and the fresh supply substituted, remained equally free from illness. A seeming exception occurred, however, at the Littleworth Co-operative Stores, in Mansfield, where potted meat bought on February 15th (after the new supply had, for the first time, been delivered on that day) proved just as virulent as before.

But Mr. X.'s traveller told me that the fresh supply distributed by him on February 15th had been taken indiscriminately from tins on Mr. X.'s premises, the traveller himself having no means of knowing whether the contents of any particular tin had been made on February 11th or on February 14th. I ascertained subsequently that certain tins of February 11th potted meat were still on Mr. X.'s premises on February 15th, and Mr. X. could not account for their disposal unless they had been carried out by the traveller on that day. Hence it seemed likely that at the Littleworth Stores it was really potted meat of February 11th which was delivered on February 15th as a fresh supply, and that the seeming exception was, in fact, no exception at all.

None of the retail shopkeepers nor any of the customers had noticed anything that they regarded as objectionable about the appearance of the potted meat. Most, however, had had their attention attracted by its red colour, as Mr. X.'s potted meat, they said, was not usually red. As to taste, some persons had considered it exceptionally nice, others thought it much as usual, while others, again, had noticed it to be "tasteless" or "mawkish" or to "taste of copper." It had not smelt objectionably.

Samples of the meat were hard to obtain. Those procured and sent to Dr. Klein were:—

1. A specimen (which had been bought on February 13th), obtained by Dr. Wills, on February 20th, from a house in Mansfield in which persons had been attacked.
2. Specimens obtained from the Littleworth Co-operative Stores on February 24th: (A.) A portion of February 11th potted meat, part of a supply consumed by, and causing illness in, the family of the manager of the stores. (B.) A portion of the potted meat supplied to the same stores on February 15th, to which I have above referred. This specimen was less red than specimen (A.).

These Littleworth samples were the only specimens that could be heard of at the time of my visit. Both had been thrown, the day before, into a dry ash heap. Portion A. was found completely wrapped up in thick paper, but portion B. was cut out of the centre of a mass of potted meat which was lying among some dry cinders.

#### *Manufacture of the Implicated Potted Meat.*

Mr. X.'s statement with regard to the manufacture of the material was to this effect:—Potted meat is usually made by him at the beginning of the week from the pieces of beef in his shop which have not been sold during the previous week. Usually he adds to the beef a small quantity of pork. Two bullocks were killed at his slaughter-house on February 4th. Both were fat beasts and in good condition. He sold beef from these carcasses up to Monday, the 10th. On the 11th he took some of this beef that was unsold—pieces of brisket and neck hanging up in his shop, and other pieces set aside on the dresser—and gave them to his assistant, Y., to make into potted meat. Mr. X. described these portions of beef as having presented in every way a good appearance. At the same time he gave Y. the hocks of two pigs to be added to the beef. These two pigs belonged to a litter of four, all slaughtered on his premises the previous day (February 10th). Y., according to custom, was to boil the beef and pork, free the cooked product from bone, mince it, add pepper and salt, and put it, with a little gravy, into certain shallow, large and small, tins usually employed for the purpose. Mr. X. had not witnessed the making of this particular compound, but told me that Y. has made potted meat under his supervision for several years, always making it in this manner. All the meat used in the preparation, Mr. X. asserted, came from his shop as above described. No



scraps of meat had been added from elsewhere. Only meat, pepper and salt, and occasionally red colouring matter, were ever employed on his premises in the manufacture of potted meat. Neither the beef used nor the potted meat made on this occasion had been weighed, but Mr. X. estimated that about 1 cwt. of potted meat had been manufactured. And, judging from the amount of potted meat recorded in Mr. X.'s books as having been supplied to retail dealers, and from the quantity which Dr. Wills and I ascertained to have been bought at Mr. X.'s shop, it seemed that at least 1 cwt. had been sold.

Now this quantity represented, of course, still more than 1 cwt. of uncooked meat with bone. The hocks of the pigs already referred to would, at Mr. X.'s maximum computation, have weighed 40 lbs. Taking the uncooked meat as 1 cwt. only, there remain, therefore, at least 72 lbs. which, according to Mr. X., consisted of beef from his shop.

Mr. X. sold the potted meat to retail tradesmen at 5*d.* a lb. He makes potted meat nearly every week in considerable quantity, and finds its manufacture profitable.

Y. confirmed Mr. X.'s statements. The beef and pork were, he said, taken by him into the preparing room. There he put them into a large iron boiler, poured in water (obtained from the public supply), lit the fire beneath, and left the compound to stew from between eleven and twelve in the forenoon to five o'clock in the afternoon. Whether the water actually boiled or not he was unable to say.\* At the end of that time Y. removed the meat from the boiler to a large tin bucket. At the same time he ladled some of the gravy from the boiler into a jug, and took it to Mrs. X. to be added to pork pies.

He next turned the meat in the bucket out on to a chopping board, freed it from bone with his hands and knife, and then put it, portion by portion, through a revolving mincing machine, adding pepper, salt, and some "Indian red" at the same time. As the meat was minced, it was replaced in the bucket. When the mincing was finished the contents of the bucket were divided among several shallow open tins, a little gravy being ladled from the boiler into each tin, in order to give consistency to the potted meat and make it set. The tins, as prepared, were placed on the dresser in the preparing room, and later in the evening were all put on a shelf in the salting room adjoining. It was from this shelf that Mr. X.'s traveller took the meat on the next and subsequent mornings, turning out the contents of each tin as required, and wrapping them in paper.

Certain points in connexion with the manufacture thus described require to be noticed.

The preparing room is habitually used as the pig slaughter-house of the establishment. On February 10th, the day before the potted meat was made, four pigs had been slaughtered here—two of the four furnished the hocks added to the preparation. Various pieces of meat from these pigs were used to make brawn on February 11th. The brawn was made in a boiler standing by the side of that used for making potted meat, and both boilers were heated at the same time. On the same day certain other portions of these pigs were made into sausages. Other parts, again, were put into brine tubs for salting.

When I first visited Mr. X., I found that two pigs had just been slaughtered in the preparing room. The carcase of one was suspended with its head in one of the boilers, and was there being scraped. Among other utensils then being used in dressing these carcasses was the bowl subsequently pointed out to me as having been employed to ladle the gravy of the potted meat. Indeed, it seemed that the workers in this room had no exact rule for the employment of particular utensils for particular purposes; those in which raw meat and sausage meat were kept and made up, for instance, appeared to be used at other times for cooked brawn and potted meat, and *vice versa*. The flat tins into which potted meat is placed when made were shown to me. Some of these tins had been very indifferently cleaned.

The preparing room is distinct from Mr. X.'s shop and dwelling-house. It is a long brick shed, lighted at the top and on one of its sides. The paving,

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\* At my request the boiler was filled with water, and a fire lighted. In less than an hour the water was boiling briskly.



made of stone flags, slopes towards the door. The waste waters of the slaughtering and dressing run beneath the door to a gutter outside, which conveys these liquids along an open yard to a trapped gully, and so to the sewer. There is no drain opening within the room itself. The mincing machine (which was fairly clean when I saw it) stands in one corner of the room. Alongside it is the sausage machine, and then comes a dresser used for preparing meat. On the opposite side of the room are the iron boilers already mentioned. Each is bricked round, and has its own furnace beneath. At the far end of the room is a pen for keeping pigs until they are slaughtered.

The salting room leads out of the preparing room. Both preparing room and salting room buildings are old, and on one side they face a house now unoccupied and ruinous. Between these rooms and the ruined house is a passage two or three feet wide, filled with old rubbish and débris. No refuse, I ascertained, had recently been put into this passage, which is, indeed, difficult to get at, and leads nowhere.

### AS TO THE SOURCE OF THE DELETERIOUS AGENT IN THE POTTED MEAT.

The potted meat had clearly become capable of causing illness while it was on Mr. X's premises. And apparently this had taken place after the cooking. The bullocks, which, according to Mr. X's account, had supplied all the beef in the potted meat, had been sold to Mr. X. in the cattle market by a dealer, who had just bought them, I was told, in order to re-sell. I could not find this dealer, and thus was unable to trace the previous history of the bullocks. But on February 10th, and for a week prior to that date, beef from these two carcasses had been sold to various persons. I could learn of no ill effects among those who had eaten it. The pigs which supplied the hocks which were added to the preparation afforded material for the brawn made at the same time, and also, later in the week, for pork pies. Both brawn and pork pies had been extensively sold, but had done no harm.

That the deleterious agent was introduced into the potted meat after it had been cooked is further indicated by the fact that the gravy obtained from the cooking of the beef and pork was straightway added to pork pies; these pies being subsequently eaten by many persons, always with impunity.

It thus became necessary to seek for a deleterious agent superadded to the potted meat somewhere in the interval between the time when the cooking was completed on February 11th, and the time when this meat was first turned out of the shallow tins in the salting room on the following day. But I could not determine at what stage of this interval such addition occurred, or in what way it had taken place. Attention was first directed to the shallow tins in which the potted meat had been stored. Did these tins already contain the deleterious agent when the potted meat was put into them? If this had been so, this agent must needs have been already present in each of several separate tins before the potted meat was added. For the contents of every one of the tins had been poisonous. But although, as I have said, certain empty potted meat tins shown to me appeared to be kept in an uncleanly condition, I could obtain no indication of a general contamination of all the tins which had been used on this occasion. Next, had these several tins been contaminated after the potted meat had been put in them? All the tins, as soon as filled, lay for a time on the dresser in the preparing room. I had no information in any way suggesting that a deleterious agent had there gained access to them. And the brawn and other materials standing on the dresser at the same time did not prove deleterious.

The tins had next been taken from the preparing room to the shelf in the salting room adjoining. Over the salting room is a loft in which sawdust is stored. An aperture in the wall above the shelf opens to a staircase leading to the loft, and through this aperture sawdust or other matters taken up or down the staircase might easily have been scattered over the tins of potted meat on the shelf. But I could not learn of any newly obtained sawdust or of other dusty material that had been taken up or down the staircase about February 11th. Moreover, if contamination had occurred in



the salting room it was to be expected that the brawn made at the same time and placed on the same shelf would also have become poisonous.

It seemed, therefore, more probable that it was in the course of the mincing and making up that the contamination took place. I obtained, however, no facts which led to the inference that Y.'s hands and knife, which were used freely in this process, were unclean, or that the mincing machine was dirty. Y. himself was in good health at the time.

As regards the materials stated to have been added to the potted meat, no suspicion attached to the pepper and salt, which had been used to season sundry other preparations. No mineral powder or other chemical substance appeared to have been added besides the "Indian red."\* This pigment had undoubtedly been employed in unusually large quantity—for what reason I could not determine—but there were no indications that, *per se*, it had been harmful. A fresh tin of "Indian red" had been obtained by Mr. X. about a month before. Pigment from this tin had been added on more than one occasion to brawn, including the brawn made on February 11th, and no ill effects were traceable to its presence there.

No new utensils had been employed in the manufacturing process, and the various receptacles in which the potted meat was prepared were made either of iron, enamelled iron, or "tin." Concerning the condition of cleanliness, or the reverse, of these receptacles and utensils at the time of preparation of the potted meat, I could obtain no information. I have already noted that some of those shown to Dr. Wills and myself were imperfectly cleaned, and that certain utensils appeared to be employed indifferently for the diverse operations carried on in the preparing room.

It is possible, of course, that in the making up of this potted meat there had been circumstances or conditions other than those of which I had information from Mr. X. or from his assistant. In view of this consideration I endeavoured to ascertain how the large amount of material resulting from the slaughtering and dressing of four pigs in the preparing room on February 10th had been disposed of or was being dealt with when the potted meat was made on February 11th. Some of it had been used for salting, and other parts were employed in sausage making, brawn making, and other processes—all of which were, I learnt, carried out in the preparing room on February 11th—and in addition there must needs have been a considerable quantity of remnants of various kinds from these carcasses which had to be disposed of. But I could not trace such remnants to the potted meat, nor indeed any other extraneous matter, and this question, therefore, I had to leave unsolved.

#### AS TO THE NATURE AND METHOD OF OPERATION OF THE DELETERIOUS AGENT.

As has been said, there was no indication that the potted meat had contained a mineral poison. And the diversity of the malady as it affected different persons, both as regards the symptoms exhibited and the severity of the illness produced, was not altogether consistent with the operation of such poison. Further, when the histories of all the cases were compared together, there did not appear to have been any general correspondence between the character and gravity of the disease produced on the one hand, and the quantity of potted meat that had been consumed on the other. In the majority of cases, too, the time which had elapsed between swallowing the meat and the onset of illness could not be reconciled with the operation of any mineral poison.

The circumstances of the outbreak as regards character and duration of illness, absence of correspondence between gravity of attack and magnitude

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\* Mr. X. stated positively that no chemical ingredients are used on his premises besides the "Indian red" and another red pigment, used exclusively for colouring "polonies." Evidence was conflicting as to the use of this "Indian red" in the preparation of Mr. X.'s potted meat. Mr. X. told me that "Indian red" was not usually employed by him for this purpose, and that before hearing of the outbreak of illness he had remonstrated with Y. for having coloured the February 11th preparation. Y., on the other hand, states that it is his custom to add some colouring to all potted meat, and that on this occasion he had merely put in a larger quantity than usual. I procured a sample of this "Indian red" for analysis. Dr. Chattaway's report on this substance is appended. It contained no mineral poison.



of dose, and the various periods of latency in those attacked, were all, however, to be accounted for if the malady had resulted from the life processes of a living organism in the potted meat. Moreover, among outbreaks of meat poisoning, which in each instance have been referred to the presence of microbes in the inculpatated meat, some have in almost every particular presented a close resemblance to this Mansfield outbreak.

It seems desirable, therefore, to consider this outbreak from the point of view that it was by the agency of micro-organic life that the material was primarily rendered infective.

In his summary of a collection of cases of meat-poisoning,\* Dr. Ballard distinguishes (1) Those caused by the introduction of a harmful microbe into the body. (2) Those caused by the introduction into the body of a poison which has already been manufactured in the meat by such microbe. (3) Those in which both microbe and its already manufactured poison have been together concerned in the illness. The distinction between the three classes is chiefly one of duration of the incubation period, which, as a rule, in the first class is long, in the second is short, and in the third is variable in the different persons attacked. Besides shortness of incubation of the induced illness, poisoning by already manufactured product is characterised (like other chemical poisons) by producing in each of the individuals who consume it an illness the severity of which is roughly proportional to the amount of poison consumed.

In this outbreak there were several examples of a long incubation—36 to 48 hours—before any symptoms of illness appeared. In these instances it may well have been that a poisonous substance was manufactured within the body after the meat had been eaten, by microbes contained in the meat. On the other hand, there were certain cases with a short incubation; nine persons were attacked within 12 hours of eating the potted meat, the shortest intervals being five hours in one person, and six hours in three others. In these cases a poisonous product already manufactured within the meat was probably the cause of the first symptoms. In a few households a short period of incubation was reported for each of the inmates attacked. In some of these households Dr. Wills and I found that the severity of attack in each person was said to have corresponded with the amount of potted meat he or she had eaten. This condition of correspondence of attack with dose was not met with in certain other households, in which the majority of those attacked were reported to have had a prolonged incubation period. In most households, however, exact information as to relation of attack to dose was not to be had; we usually found, indeed, that quite a small quantity of potted meat had been sufficient to cause serious illness. In view of this fact, and of the small number of the cases in which symptoms appeared in less than twelve hours, I am disposed to infer that few out of those attacked owed their illness directly to poisonous substances already present in the potted meat when swallowed.

On tabulating 218 cases in which Dr. Wills or I had been able to obtain information as to the period of incubation, it appeared that, taken broadly, those persons who ate the potted meat soonest after its manufacture had a shorter period of incubation; while those who ate this preparation on later days had a longer incubation period. Thus:—

#### PERIODS OF INCUBATION.

—	5-12 hrs.	12-18 hrs.	18-24 hrs.	24-36 hrs.	Total.
Number of persons eating potted meat—					
On Feb. 12 - - -	4	18	16	—	38
„ 13 - - -	3	20	27	9	59
„ 14 - - -	2	24	40	18	84
„ 15 - - -	—	2	25	10	37
	9	64	108	37	218

\* Report of the Medical Officer of the Local Government Board for 1890, p. 200.



Several possible occurrences may be thought of as explaining the increase, from day to day, in length of incubation period indicated in this table. Those who ate the meat on February 12th might perhaps have been consuming an already manufactured chemical poison, which, being unstable, gradually disappeared from the preparation as time went on. Or, setting aside (for reasons already indicated) the question of superadded chemical poison, it may be supposed that the hypothetical microbe capable of causing the mischief was, on February 11th, in a condition in which it could rapidly develop its products in the alimentary canal, or was present in the potted meat in maximum quantity on that day; while on the later days it had so far diminished in virulence or in quantity as to require a longer time to elaborate these products. Such an effect upon the infecting microbe might be due merely to such physical conditions as exposure to air and to changes of temperature; or, on the other hand, it might have resulted from chemical changes, which rendered the meat from day to day less suitable as a multiplying ground for this particular microbe. It will be seen from Dr. Klein's report that he found microbes in an altogether "unusual and remarkable" number in each specimen of the potted meat he examined, the most abundant form being *proteus vulgaris* and *bacillus coli*.

Now either of these abundant micro-organisms, finding in the potted meat a suitable pabulum, and there multiplying must needs have thereby influenced, favourably or adversely, the infecting microbe by hypothesis also present in the meat. Seeing that the dominant organisms found by Dr. Klein are capable of producing very different chemical substances (*bacillus coli*, for instance, habitually forming acid and *bacillus proteus* alkaline products), and that their multiplying ground, the potted meat, itself consisted of a medley of material, it is quite likely that the hypothetical infecting microbe was, as time went on, now fostered, now inhibited, as a result of some of the chemical changes effected in the meat by bacterial action.

In certain outbreaks of meat poisoning which are comparable to the present occurrence at Mansfield, it has been possible to detect in the inculpatated meat a microbe which possessed infective properties, and to refer the particular outbreak to the presence of this micro-organism. Such an instance was furnished by the Welbeck ham poisoning case, and by others recorded by Dr. Ballard in his summary.\* It will be seen from Dr. Klein's report that although a large number of microbes of different sorts existed in each specimen of the Mansfield potted meat sent to him, no organism which can in this sense be considered to possess specifically infective properties was detected among them.†

But, as has been said, Dr. Klein has found that *bacillus proteus* and *bacillus coli* were present in the potted meat in an altogether unusual and remarkable number. And he points out that both of these common microbes decompose albuminous substances into poisonous products, and that either might, under exceptional conditions, itself manufacture such products within the human body in such a way as to cause symptoms of poisoning. He indicates that such exceptional conditions may be fulfilled in a disturbance of digestive function, and that this potted meat may very well have caused a disturbance of this kind—either because the simultaneous introduction of the "Indian red," which proved to be strongly alkaline, was sufficient to neutralise the gastric juice, or because there was introduced with the potted meat a quantity of already manufactured bye-products of the numerous microbes detected in the preparation—bye-products, perhaps, sufficient of themselves to derange digestion in the human stomach.

May 1896.

G. S. BUCHANAN.

\* See also Polin et Labit: "Etude sur les empoisonnements alimentaires;" Octave Doin; Paris, 1890.

† Dr. Klein received the first sample 11 days, and the second samples 17 days after the potted meat had been manufactured.



## ADDENDUM A.

REPORT by Dr. KLEIN, F.R.S.

I. Upon a SPECIMEN of POTTED MEAT received on February 22nd, 1896. Obtained and sent by Dr. WILLS, as a Sample of Potted Meat made by Mr. X. on February 11th.

This potted meat was of a red colour, and had a natural appearance to the unaided eye. It had no offensive smell. Examined microscopically it was found to contain micro-organisms in abundance. There were numerous bacilli of various sizes, and cocci, both in the form of diplococci and in chains.

In order to isolate the several species of microbes present, cultivations of the meat were made in gelatine and Agar plates. Each plate was inoculated with a trace of the potted meat taken up with the loop of a platinum needle. In every one of the gelatine and Agar plates the number of colonies which developed was so large that it was impossible to count them.

By subculture from these plates I isolated the following species of microbes :—

- (1.) *Staphylococcus albus non-liquescens*.—A variety growing scantily on gelatine, but multiplying rapidly on Agar at 37° C.
- (2.) A motile bacillus rapidly liquefying gelatine which corresponded in all respects with *proteus vulgaris*. This was the species present in greatest abundance both in the gelatine and in the Agar plates.
- (3.) *Bacillus coli*.—Comparatively few colonies.

This sample of meat was given as food to mice, four of which animals were fed upon it for two successive days. No ill effect was produced in them.

II. Upon SPECIMENS received from Dr. BUCHANAN on February 26th.

These consisted of—

*Sample of potted meat A*.—Potted meat manufactured on February 11th by Mr. X.

*Sample of potted meat B*.—Potted meat which caused illness, but which, on the ground of its paler colour, was suspected to have had an origin different from that of sample A.

*Bottle containing "Indian red" colouring water*, used in the preparation of Mr. X.'s potted meat of February 11th.

A portion of this pigment was submitted to Dr. Chattaway for analysis. His report is subjoined.

*Sample A*, when examined microscopically, showed an enormous number of microbes, bacilli of different sizes, cocci, yeast cells, and a few spores.

Cultivations from this specimen were made in gelatine and Agar plates as before. The colonies developed in as great an abundance as in the specimen sent by Dr. Wills.

By subculture from the plates I obtained the following species of microbes :—

- (a.) *Typical proteus vulgaris*.—This was the species present in greatest abundance in the plates.
- (b.) A variety of *proteus vulgaris*, liquefying gelatine with less rapidity than typical *proteus*, and forming more voluminous flocculi in the liquefied medium. This species was also abundant in the plates.
- (c.) *Proteus Zenkeri*.—A few colonies.
- (d.) *Bacillus coli*.—A large number of colonies.
- (e.) *Staphylococcus albus non-liquescens*.—A few colonies.
- (f.) *Staphylococcus albus liquescens*.—A few colonies.
- (g.) A few colonies of moulds.

*Sample B*.—The surface of this sample was covered with mould. On cutting into it numerous red spots of pigment were seen, although the pigment was present in less quantity than in sample A.

A particle of the meat taken from the centre of the sample showed a large number of microbes; bacilli of various sizes, cocci, mycelial threads, and spores of moulds.

Cultivations from this specimen were made in gelatine and Agar plates as before. The colonies developed in as great abundance as in the previous specimens.

By subculture I obtained the following species :—

- (1.) Typical *proteus vulgaris*, the colonies of this species predominating in number as before.
- (2.) *Proteus vulgaris* of variety (b.) above.
- (3.) *Proteus Zenkeri*.—Numerous colonies.
- (4.) *Bacillus coli*.—A large number of colonies.
- (5.) *Staphylococcus albus liquescens* and *non-liquescens*.
- (6.) Numerous colonies of moulds.



With portions of sample A. four mice were fed, and four other mice were given sample B. as food. The animals consumed a considerable amount of each sample. No ill effects resulted in any of them. Two mice were fed on bread and milk to which the "Indian red" colouring matter had been added in large quantity. Both remained well.

The virulence of each of the species of proteus above distinguished as (*a.*) and (*b.*) was separately tested. Thus 1 c.c. of a broth culture of proteus (*a.*), incubated at 37° C. for 48 hours, and already crowded with microbes, was injected subcutaneously into the groin of each of a series of four guinea-pigs; 24 hours after the injection each animal presented an extensive œdematous swelling in the groin, abdomen, and chest. All the animals were quiet, and did not feed. Death occurred in 48 hours. Post mortem it was found that in each instance the subcutaneous tissue of the groin, the abdomen, and chest was much swollen by malodorous blood-stained fluid. The muscular tissue beneath was gangrenous; the intestines were injected, relaxed, and contained a blood-stained mucus; the spleen was dark and slightly enlarged. The fluid in the subcutaneous tissue was full of *b. proteus*, and the organism was also found in large numbers in the spleen.

These results are comparable to those usually produced when broth cultures of ordinary specimens of proteus vulgaris—such as occur, for example, in putrid meat—are tested by inoculation into guinea-pigs. It may be noted, however, that in order to produce results such as those just described, the broth culture of an ordinary specimen of proteus would have to be injected in a quantity somewhat larger than the 1 c.c. used in this instance. Wherefore the particular proteus (*a.*) was, if anything, more virulent than usual to this test.

Broth-cultures of proteus (*b.*) were made and tested in the same way. Each of the four guinea-pigs which were injected subcutaneously in the groin with 1 c.c. of this culture, presented at the end of 24 hours the same appearance of œdema and other signs of illness as those injected with proteus (*a.*). At the end of 48 hours, however, these guinea-pigs were a little better, and in 72 hours all were distinctly better and recovering.

In order to determine whether the admixture of the colouring matter had any effect upon the microbes, I added some of the "Indian red" to broth and to gelatine in a quantity sufficient to stain these culture media a deep red. I then sterilised the media, and employed them for the growth of the following organisms isolated from the potted meat:—

*Proteus (a.)*, incubated on the coloured gelatine at 20° C., grew copiously and in a normal manner. The colouring matter became paler. *Proteus (b.)*, treated in the same manner, behaved similarly, and produced a like result in decolourising the gelatine.

A coloured broth-culture of each of these organisms, incubated at 37°, was used in each instance to inoculate guinea-pigs in the manner above described. No difference was found to exist in either instance between the virulence of the coloured broth-culture of the organism and the virulence of uncoloured broth-cultures of the microbes.

*Proteus Zenkeri*, incubated on the coloured gelatine at 20° C., showed only a scanty growth. It did not affect the colour of the gelatine.

*Bacillus coli*, incubated in the same way, also showed scanty growth, and did not affect the colour of the gelatine.

*Staphylococcus albus non liquescens* (from sample A. of February 22nd) was grown both in ordinary and in coloured broth. In the latter medium the growth was very feeble. In the former it was abundant. The uncoloured broth-culture, however, was harmless to guinea-pigs when injected subcutaneously in doses of 1 c.c.

#### Observations.

Judging from the large number of colonies which developed from the inoculation of culture media with a mere trace of meat from each of the specimens, it seems that microbes were present in this potted meat in an altogether unusual and remarkable quantity. The organisms isolated are of a kind commonly associated with the decomposition of albuminous substances. One of them, bacillus proteus, although essentially a saprophyte, produces by its action upon albuminous matter substances which are poisonous to man. Another, bacillus coli, is also capable of producing poisonous alkaloids. Now food in which slight decomposition has been set up by proteus is not unfrequently harmless to its consumer. But such food can very rarely contain the microbe in such an abundance as was found in each of these samples of potted meat. And when incipiently decomposed food of this sort is eaten with impunity there is reason to believe that the proteus bacilli (which require an alkaline medium for their rapid multiplication) are destroyed, on reaching the stomach, by the action of the acid gastric juice.

Now in this case Dr. Chattaway reports that the "Indian red" colouring matter, present in large quantities in the preparation, contained no less than 90 per cent. of sodium bicarbonate. Thus, accompanying the large number of proteus bacilli in the potted meat, there was also present an alkali which would neutralise the gastric juice. Moreover, the large number of other microbes—such as bacillus coli—present in the potted meat would have already manufactured therein products which were likely to interfere with the



digestive processes of the stomach. For these reasons it is probable that if potted meat of the kind I received were consumed, the proteus bacilli would neither be destroyed by digestion nor have their growth inhibited by gastric juice. They would pass in large numbers into the duodenum and small intestines. Here everything would favour their growth, and the rapid development of their poisonous products. They would then reach an alkaline medium, and would rapidly multiply at the body temperature. It may be remembered that a broth culture of bacillus proteus incubated at 37° C. will become thick with microbes in as short a time as 12 hours.

In connexion with the harmlessness of the potted meat when given as food to mice, it should be remembered that mice and other rodents are not susceptible to poisoning by the ingestion of putrid materials, and this immunity does not, therefore, indicate a corresponding harmlessness to the human consumer.

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## ADDENDUM B.

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REPORT by DR. CHATTAWAY, D.Sc., PH.D., on a Sample of Red Colouring Matter labelled "Indian Red."

The sample of colouring matter supplied is a soft crimson powder readily soluble in water, giving a deep red solution which dyes wool a bright red colour.

This colouring matter is found to be entirely free from arsenic and all other mineral poisons, and to contain no iron.

Its general properties and freedom from iron show that it actually contains no "Indian red," which is a naturally occurring earthy substance, very rich in ferric oxide, and much used as an insoluble and permanent deep red pigment.

The substance is found to consist of a deep red colouring matter mixed with about 90 per cent. of sodium bicarbonate and a little salt, these latter being added probably to cheapen the product, and to bring out the colour more obviously.

The colouring matter itself belongs to the class of azo-colours, a series of compounds derived from coal tar, and containing one or more of the diatomic groups —  $N = N$  — linking together acid or basic aromatic radicles. Some of these compounds are of great technical value, and are manufactured in large quantities, owing to their importance as dye stuffs.

This colour is an acid azo-red containing sulphonic groups, and probably obtained from derivatives of naphthaline. Such colours are not usually considered poisonous, but their physiological action has not, so far as I am aware, been investigated.

It seems probable that the mixture is a red organic colouring matter such as is sold for the purpose of tinting food stuffs, *e.g.*, sweets, jellies, &c., and may have been supplied in mistake for the "Indian red" (either native or an artificial imitation, consisting of ferric oxide) usually mixed with the potted meat to render it of more attractive appearance.

Chemical Laboratory,  
St. Bartholomew's Hospital,  
March 6, 1896.

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